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ORIGINAL RESEARCH

Environmental and social barriers to active school transport in the Colombian Caribbean region

Barreras ambientales y sociales para el trasporte activo a la escuela en el Caribe colombiano

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Abstract

Introduction: Lack of physical activity and high obesity rates in children and adolescents are major public health concerns. Active school transport is a strategy that can contribute to achieving recommended physical activity levels.
Objective: To determine the relationship between the use of active school transport by children from the Colombian Caribbean region and their parents' perception of barriers to active school transport.
Materials and methods: Cross-sectional study conducted in 2019 with data from 3 067 primary school children from the Colombian Caribbean region. Data were obtained by administering an ad hoc questionnaire (questions on how children commuted to school and about their academic and sociodemographic characteristics) and the Active School Transport Barriers scale to the parents or legal guardians of the children. A multivariate logistic regression analysis was performed in which Odds ratios (OR) and their respective 95% confidence intervals (95%CI) were calculated to determine the relationship between the modality of transportation to school (active/passive) and the barriers to active school transport perceived by the students' parents.
Results: A total of 51.3% of the schoolchildren actively transported to school. Factors such as considering that the roads are not appealing (OR=1.64; 95%CI: 1.39-1.94), that there are dangerous road crossings on the route (OR=1.29; 95%CI: 1.1-1.54), that the distance between home and school is very long (OR=1.83; 95%CI: 1.5-2.1), and that the traffic on the route is heavy, (OR=1.5; 95%CI: 1.2-1.8) increased the probability of passive transportation (i.e., using motor vehicles).
Conclusion: In the present study, long distances between home and school, aesthetics of roads, heavy traffic on the route, and insecurity of road crossings, among others, were identified as barriers to the use of active school transport.

Resumen

Introducción. La falta de actividad física y los altos niveles de obesidad en niños y adolescentes son problemas importantes de salud pública. El transporte activo a la escuela es una estrategia para alcanzar las recomendaciones de actividad física.
Objetivo. Determinar la relación entre el uso de transporte activo a la escuela en niños de la región Caribe colombiana y la percepción de sus padres sobre las barreras para el transporte activo a la escuela.
Materiales y métodos. Estudio transversal realizado en 2019 con datos de 3 067 escolares de básica primaria de la región Caribe colombiana. Los datos se obtuvieron mediante la administración de un cuestionario *ad hoc* (preguntas sobre cómo se transportaban los niños a la escuela y sobre sus características académicas y sociodemográficas) y la Escala Barreras en el Transporte Activo al Centro Escolar a los padres o representantes legales de los niños. Se realizó un análisis de regresión logística multivariada en el que se calcularon Odds ratios (OR) y sus respectivos intervalos de confianza al 95% (IC95%) para determinar la relación entre la modalidad de transporte a la escuela (activo/pasivo) y las barreras para el transporte activo a la escuela percibidas por los padres de familia de los estudiantes.
Resultados. El 51.3% de los escolares se transporta de manera activa al colegio. Factores como considerar que los caminos son poco atractivos (OR=1.64; IC95%: 1.39-1.94), que hay cruces peligrosos en el trayecto (OR=1.29; IC95%: 1.1-1.54), que la distancia entre la casa y el colegio es muy larga (OR=1.83; IC95%: 1.5-2.1) y que hay mucho tráfico en el recorrido (OR=1.5; IC95%: 1.2-1.8) aumentaron la probabilidad de transportarse de manera pasiva (en medios motorizados).
Conclusión. En el presente estudio, las largas distancias entre la casa y el colegio, la estética de los caminos, la presencia de mucho tráfico en el trayecto, la inseguridad de los cruces viales, entre otras, se identificaron como barreras para el uso del transporte activo a la escuela.

Introduction

Non-compliance with physical activity (PA) recommendations and a rise in sedentary habits are becoming increasingly evident in the world's population. This leads to a higher risk of chronic noncommunicable diseases[1,2] and has become a public health problem that mainly affects the well-being of children and adolescents due to growing obesity rates in this population.[3] The World Health Organization (WHO)[4] states that children and adolescents should perform at least 60 minutes of moderate to vigorous PA daily; however, as reported by Foster *et al.*,[5] children are not getting enough PA, with only 1 in 3 engaging in PA on a daily basis.

Although several countries have implemented strategies to promote PA among children and adolescents, it is still low in this population.[6] For example, it has been reported in the United Kingdom that only 21% of boys and 16% of girls between 5 and 15 years of age meet the recommended PA levels.[7] In Mexico, it has been established that high rates of overweight and obesity among children and adolescents (almost 35%) are associated with low PA.[8] In Colombia, Herazo-Beltrán *et al.*[9] have reported that 64.3% of the 3 598 students aged 10-14 years attending public schools included in their study do not perform PA; moreover, according to the *Encuesta Nacional de la Situación Nutricional 2015* (2015 National Survey of the Nutritional Situation),[10] 24.4% of children (5 and 12 years) and 17.9% of adolescents (13-17 years) in the country are overweight or obese. Furthermore, according to the study by Gonzáles *et al.*,[11] conducted using data from the *Reporte de Calificaciones en Actividad Física en niños y Adolescentes Colombia 2018* (2018 Report on Physical Activity Scores in Children and Adolescents in Colombia), only 35.5% of Colombian children aged 6 to 17 years perform PA for at least 60 minutes per day for 4 or more days per week.

Thus, given that the figures of low PA levels and high sedentary behavior in children and adolescents are alarming worldwide, it is important to consider active school transport (walking or cycling) as a preventive strategy that contributes significantly to meeting the minimum PA recommendations.[12] Benefits of this method include cardiovascular health, cognitive performance, motor skill development, weight loss, and the opportunity for interaction with family and friends.[13,14] Moreover, active transport is a key component of a healthy lifestyle that not only improves children's health through PA, but also has other advantages such as reducing traffic congestion and minimizing noise pollution.[15]

Several studies have looked into the relationship between active transport and compliance with PA recommendations. Kek *et al.*,[16] in a study involving 314 adolescents in Dunedin (New Zealand), reported that 39.2% of the participants met the minimum PA requirements, and that 47.9% and 33.5% of these adolescents used active school transport and motorized transport, respectively. In turn, Martínez-Martínez *et al.*,[17] in a study in 455 Spanish 9-year-old children, found that active school transport was positively correlated with PA levels (r=0.324, p≤0.001). Finally, Yang *et al.*,[18] in a study in which they analyzed data from the China Health and Nutrition Survey obtained between 1997 and 2011 (9 487 participants aged 6 to 17 years), established that children who lived in a metropolitan area and did more than 40 minutes of total PA per day were less likely to report using active school transport.

Similarly, given the importance of active transport, there are several studies that have analyzed the means of transportation to school. In the United States, Kontou *et al.*[19] found that 50.2% of schoolchildren get to school by car and 36.6% by school bus. In Chile,

Rodríguez- Rodríguez *et al.*[20] reported that only 11% of children and 24.8% of adolescents walk to school and that the car was the most frequent means of transportation to school (64.9% and 50.2%, respectively), followed by motorcycle in children (14.9%) and public bus in adolescents (22.5%). In Brazil, Camargo *et al.*[21] established that the prevalence of the use of active transport to school among adolescents was 37.7%, being higher in girls (21.5%) than in boys (16.2%).

Active transport rates in children and adolescents worldwide are decreasing every day. This is associated with different factors that increase or limit walking or cycling to school, including factors in the natural and built environment such as the unavailability of walking routes, heavy vehicular traffic, and the perception of insecurity in the neighborhood, among others.[1,22] The social ecological model provides a framework for understanding the multiple factors underlying the physical and social environment that can influence active transport.[23,24] In this sense, an ecological approach is essential for designing and implementing multilevel interventions to promote active school transport.[25]

In Colombia, a number of studies have been conducted to characterize the way children and adolescents commute to school.[26] However, evidence on the barriers that limit the use of active transport in this population is scarce. In light of the foregoing, the objective of the present study was to determine the relationship between the use of active school transport by children in the Colombian Caribbean region and their parents' perception of the barriers to active school transport.

Materials and methods

Study type and sample

Cross-sectional study conducted in 3 067 elementary school children (from first to fifth grade) who attended 15 educational institutions in the Colombian Caribbean region during 2019. Of these 15 schools, 8 are located in municipalities with more than 500 000 inhabitants and 7 in municipalities with less than 500 000 inhabitants.

Sample size was determined based on the total number of schoolchildren enrolled in the 15 institutions during the study year (N=9 871), considering a confidence level of 95%, a statistical power of 80%, and a margin of error of 5%. Students enrolled in elementary school and whose parents gave their consent to participate in the study were included; students with a physical disability were excluded. Two-stage random sampling was used: in the first stage, a random selection of the classes in these school years (first to fifth grade) was made in the 15 schools, and in the second stage, the students in these classes were randomly recruited based on the registration list provided by the educational institution.

Procedure

Prior to data collection, the principals of the educational institutions were asked for permission to administer the instruments. Once permission was obtained, a meeting was organized with the students of each school and their parents and/or legal guardians to explain the objectives and procedures of the study. Then, the parents and/or legal guardians were asked to sign the informed consent form and the students were asked to agree to participate in the study.

Afterwards, the parents and/or legal guardians of the schoolchildren who agreed to participate in the study filled out the evaluation instruments: an ad hoc survey with

questions on how the children commuted to their schools and their sociodemographic and academic characteristics (sex, age and school year in which they were enrolled), and the Active School Transport Barriers scale (BATACE by its acronym in Spanish). These instruments are described below.

Active school transport was evaluated by asking the question 'How do you usually commute to school?', which had the following response options: walking, using a bicycle, private car, public transport, school transport (bus/bus), and motorcycle. Walking or cycling to and from school were considered active school transport.[27]

Perceived barriers to active school transport were assessed using BATACE, an instrument consisting of 18 items: 11 on environmental/safety barriers (items 1, 2, 3, 4, 11, 12, 13, 14, 16, 17, and 18) and 7 on planning/psychosocial barriers (items 5, 6, 7, 8, 9, 10, and 15).[28]

A four-point Likert scale was used to respond to each question, where 1 stands for Strongly Disagree, 2 for Somewhat Disagree, 3 for Somewhat Agree, and 4 for Strongly Agree. The validity of the scale was assessed as good, with Cronbach's alpha and intraclass correlation coefficient values of 0.72 and 0.64 and 0.68 and 0.77 for the questions on environmental barriers and on planning and psychosocial aspects, respectively.[28]

Statistical analysis

Data processing and analysis were performed with SPSS version 24.0. Absolute frequencies and percentages were used for the analysis of categorical variables and means and standard deviations were used for quantitative variables. A logistic regression analysis was also performed, binary first for each perceived barrier and the type of active or passive transport, and then multivariate for the above variables depending on the territorial context. In both analyses, Odds Ratios (OR) and their respective 95% confidence intervals (95%CI) were calculated, with a statistical significance level of 0.05, to determine the relationship between the mode of transport to school (active or passive) and the environmental and social barriers to active school transport perceived by parents.

Ethical considerations

The study followed the ethical principles for biomedical research involving human subjects established in the Declaration of Helsinki[29] and the scientific, technical and administrative standards for health research in Resolution 8430 of 1993 of the Colombian Ministry of Health.[30] The study protocol and evaluation instruments were reviewed and approved by the Ethics Committee of the Universidad Simón Bolívar in accordance with Minutes No. CEI-USB-CE-0198-00 of May 26, 2017.

Results

The mean age of the participants was 8.34±1.69 years, 53.11% were male, 60.90% resided in cities with more than 500 000 inhabitants, and the school grade with the highest number of participants was fifth grade (21.19%) (Table 1).

Regarding the mode of travel to school, 51.29% used active transport (walking or bicycling). In addition, walking was the most frequent mode of travel (40.26%), followed by commute by motorcycle (25%) (Table 2).

Table 1. General characteristics of participating schoolchildren (n=3 067).

Characteristics		Frequency	Percentage
Sex	Female	1 438	46.88
	Male	1 629	53.11
Age	5 years old	67	2.18
	6 years old	465	15.16
	7 years old	530	17.28
	8 years old	539	17.57
	9 years old	630	20.54
	10 years old	499	16.26
	11 years old	214	6.97
	12 years old	123	4.01
School grade	First	584	19.04
	Second	586	19.10
	Third	607	19.79
	Fourth	640	20.86
	Fifth	650	21.19
Cities	More than 500 000 inhabitants	1 868	60.90
	Less than 500 000 inhabitants	1 199	39.10

Table 2. Schoolchildren's commute from home to school (n=3 067).

Transport		Frequency	Percentage
Modes of transport	Active	1 573	51.29
	Motorized	1 494	48.71
Types of transport	Walking	1 235	40.26
	Bicycling	338	11.02
	Private car	463	15.09
	Public transportation	184	5.99
	School transport	80	2.61
	Motorcycle	767	25

Environmental barriers related to non-use of active transport from home to school were: the route is boring (OR=1.64; 95%CI: 1.39-1.94), presence of one or more dangerous crossings (OR=1.29; 95%CI: 1.10-1.54), long distances (OR=1.83; 95%CI: 1.56-2.15), and heavy traffic (OR=1.5; 95%CI: 1.24-1.83). On the other hand, the planning or psychosocial barriers related to not using active were transport include: walking or cycling is not considered appealing (OR=1.42; 95%CI: 1.19-1.69) and it is easier to drive or get a ride (to school) (OR=1.24; 95%CI: 1.1-1.69) (Table 3).

Table 3. Environmental and social barriers to active school transport perceived by parents of schoolchildren and their relationship to mode of travel to school.

Barriers	Parents' perception	General population n (%)	Motorized transport n (%)	Active transport n (%)	OR	95%CI
1. No sidewalks or bicycle lanes	Agree/Strongly agree	1 979 (64.53%)	993 (50.17%)	986 (49.83%)	0.69	0.57-0.83
	Disagree/Strongly Disagree	1 088 (35.47%)	501 (46.04%)	587 (53.96%)	1	
2. The route is boring	Agree/Strongly agree	1 413 (46.09%)	813 (57.53%)	600 (42.47%)	1.64	1.39-1.94
	Disagree/Strongly Disagree	1 654 (53.91%)	681 (41.17%)	973 (58.83%)	1	
3. The road is not well lit	Agree/Strongly agree	1 560 (50.86%)	808 (51.79%)	752 (48.21%)	0.79	0.66-0.94
	Disagree/Strongly Disagree	1 507 (49.14%)	686 (45.52%)	821 (54.48%)	1	
4. There are one or more dangerous crossings	Agree/Strongly agree	2 038 (66.44%)	1 086 (53.28%)	952 (46.72%)	1.29	1.10-1.54
	Disagree/Strongly Disagree	1 029 (33.66%)	408 (39.65%)	621 (60.35%)	1	
5. It is too hot and I sweat or it rains all the time.	Agree/Strongly agree	1 814 (59.14%)	938 (51.70%)	876 (48.30%)	0.94	0.79-1.15
	Disagree/Strongly Disagree	1 253 (40.86%)	556 (44.37%)	697 (55.63%)	1	
6. Other students do not walk or bike	Agree/Strongly agree	1 439 (46.91%)	765 (53.16%)	674 (46.84%)	1.02	0.86-1.21
	Disagree/Strongly Disagree	1 628 (53.09%)	729 (44.77%)	899 (55.33%)	1	
7. Walking and cycling are not considered appealing	Agree/Strongly agree	1 255 (40.91%)	726 (57.84%)	529 (42.16%)	1.42	1.19-1.69
	Disagree/Strongly Disagree	1 812 (59.09%)	768 (42.38%)	1044 (57.62%)	1	
8. I carry too much stuff	Agree/Strongly agree	1 729 (56.37%)	920 (53.20%)	809 (46.80%)	1.12	0.95-1.33
	Disagree/Strongly Disagree	1 338 (43.63%)	574 (42.89%)	764 (57.11%)	1	
9. It is easier to drive or get a ride	Agree/Strongly agree	1 917 (62.50%)	1 018 (53.10%)	899 (46.90%)	1.24	1.1-1.69
	Disagree/Strongly Disagree	1 150 (37.50%)	476 (41.39%)	674 (58.61%)	1	
10. Too much advance planning is required	Agree/Strongly agree	1 478 (48.19%)	787 (53.24%)	691 (46.76%)	1.06	0.90-1.25
	Disagree/Strongly Disagree	1 589 (51.81%)	707 (44.49%)	882 (55.51%)	1	
11. No safe place to park the bike	Agree/Strongly agree	2 323 (75.74%)	1 167 (50.2%)	1 156 (49.8%)	1.09	0.90-1.32
	Disagree/Strongly Disagree	744 (24.26%)	327 (44%)	417 (56%)	1	
12. There are stray dogs	Agree/strongly agree	2 230 (72.70%)	1 166 (52.28%)	1 064 (47.72%)	1.20	0.99-1.45
	Disagree/Strongly Disagree	837 (27.30%)	328 (39.18%)	509 (60.82%)	1	
13. It is too far	Agree/strongly agree	1 520 (49.55%)	891 (58.61%)	629 (41.39%)	1.83	1.56-2.15
	Disagree/Strongly Disagree	1 547 (50.45%)	603 (38.97%)	944 (61.03%)	1	
14. Unsafe locations due to crime	Agree/strongly agree	1 980 (64.55%)	1 049 (52.97%)	931 (47.03%)	1.2	1.1-1.42
	Disagree/Strongly Disagree	1 087 (35.45%)	445 (40.93%)	642 (59.07%)	1	
15. I do not enjoy walking or biking to school	Agree/strongly agree	1 563 (50.96%)	833 (53.29%)	730 (46.71%)	1.15	0.98-1.36
	Disagree/Strongly Disagree	1 504 (49.04%)	661 (43.94%)	843 (56.16%)	1	
16. There are too many slopes	Agree/strongly agree	1 476 (48.12%)	763 (51.69%)	713 (48.31%)	0.82	0.69-0.97
	Disagree/Strongly Disagree	1 591 (51.88%)	731 (45.96%)	860 (54.14%)	1	
17. Heavy traffic	Agree/strongly agree	2 209 (72.02%)	1 172 (53.05%)	1 037 (46.95%)	1.5	1.24-1.83
	Disagree/Strongly Disagree	858 (27.98%)	322 (37.52%)	536 (62.48%)	1	
18. Bicycle lanes are occupied by pedestrians	Agree/strongly agree	1 371 (44.70%)	736 (53.68%)	635 (46.32%)	0.93	0.78-1.1
	Disagree/Strongly Disagree	1 696 (55.30%)	758 (44.69%)	938 (55.31%)	1	

Furthermore, when performing this analysis according to population density, it was found that the following barriers were significantly related to not using active school transport in participants residing in a municipality with more than 500 000 inhabitants: considering the route boring (OR=2.05; 95%CI: 1.62-2.61), driving or getting a ride (to the student) is easier (OR=1.42; 95%CI: 1.11-1. 72), there are no places to park the bicycle safely (OR=1.50, 95%CI: 1.21-1.95), long distances (OR=1.68; 95%CI: 1.37-2.01), and heavy traffic (OR 1.68; 95%CI: 1.34-2.17). On the other hand, in the case of individuals residing in municipalities with less than 500 000 inhabitants, the following barriers were significantly related to not using active school transport: dangerous crossings (OR=2.56; 95%CI: 1.87-3.52), other students not walking or cycling (OR=1.60; 95%CI: 1.24-2.35), not considering walking or cycling appealing (OR=1.56; (C95%: 1.24-2.12), and long distances (OR=1.95; 95%CI: 1.43-2.67). Considering that the school is far from the home was a factor that positively influenced the use of motorized transport in both groups (OR=1.68; 95%CI: 1.37-2.01 and OR=1.95; 95%CI: 1.43-2.67, respectively) (Table 4).

Table 4. Relationship between the mode of travel to school and the environmental and social barriers to active school transport in the participants depending on the number of inhabitants of the municipality in which the school is located.

Barriers	Municipalities with more than 500 000 inhabitants		Municipalities with less than 500 000 inhabitants	
	OR	95%CI	OR	95%CI
No sidewalks or bicycle lanes	0.46	0.36-0.59	1.28	0.92-1.88
The route is boring	2.05	1.62-2.61	1.43	1.11-1.86
The road is not well lit	0.86	0.68-1.08	0.67	0.45-0.91
There are one or more dangerous crossings	0.92	0.73-1.17	2.56	1.87-3.52
It is too hot and I sweat or it rains all the time	0.97	0.77-1.23	1.01	0.78-1.35
Other students do not walk or bike	0.73	0.52-0.91	1.6	1.24-2.35
Walking and cycling are not considered appealing	1.29	1.11-1.63	1.56	1.24-2.12
I carry too much stuff	1.06	0.87-1.34	1.17	0.86-1.63
It is easier to drive or get a ride	1.42	1.11-1.72	1.13	0.87-2.01
Too much advance planning is required	0.84	0.63-1.05	1.18	0.84-1.65
No safe place to park the bike	1.50	1.21-1.95	0.54	0.32-0.78
There are stray dogs	0.98	0.73-1.24	1.42	0.91-2.13
It is too far	1.68	1.37-2.01	1.95	1.43-2.67
Unsafe locations due to crime	1.21	0.91-1.54	0.91	0.63-1.24
I do not enjoy walking or biking to school	1.40	1.14-1.78	1.18	0.86-1.53
There are too many slopes	1.02	0.83-1.25	0.54	0.34-0.76
Heavy traffic	1.68	1.34-2.17	1.16	0.82-1.64
Bicycle lanes are occupied by pedestrians	0.97	0.78-1.26	1.18	0.83-1.66

Discussion

The results of the present study show that although just over half of the schoolchildren surveyed commute from home to school actively, with walking being the most frequent mode of transportation, the percentage of participants who commute passively is considerable (48.71%). The present study also found that the aesthetics of roads, insecurity at

road crossings, not considering walking or cycling appealing, the distance between home and school, and the presence of heavy traffic on the route were environmental and social barriers related to not using active school transport, while adequate lighting of the route, availability of sidewalks and bicycle lanes, and the absence of slopes on the route were factors related to the use of active transport.

Physical activity through walking or cycling generates chemical, mechanical and thermal stimuli that have a positive effect on metabolic, cardiovascular and ventilatory function, which increases cardiorespiratory capacity and muscle strength.[31] In this sense, active school transport is considered one of the main opportunities to promote PA in children and adolescents,[32] and its reduction is considered a risk factor for low physical fitness.[33]

The frequency with which children use active transport modes to school varies, as it has been established that the prevalence rate in the United States, Canada and Ireland is below 25%, while in countries such as Mexico, Switzerland, Denmark and the Netherlands the rate is over 70%.[34] Moreover, despite several studies recommending more than 15 minutes of active transport per day to improve mental and physical health and subjective happiness levels in children and adolescents,[28,35] active transport use rates tend to decline. This was reported by Chillón *et al.*[36] in a study that attempted to evaluate the variation in the frequency of active school transport over a 6-year period with data from Spanish adolescents aged 13 to 17 years included in two cross-sectional studies conducted in 2001-2022 (415 adolescents in total; 198 females) and 2006-2007 (891 in total; 448 females). They found that while no significant change in the frequency of active transport use was observed in boys (44% vs. 49%; p=0.269), in girls it decreased from 61% to 48% (p=0.002) and bus/metro use increased from 25% to 37%.

In the present study, walking was the most frequent form of transportation to school (40.26%), which coincides with the findings of other studies conducted in Colombia. For example, González *et al.*[37] found in their study of 912 schoolchildren in Bogotá that 71.6% of the participants walked to school, while Arango *et al.*,[26] in a study of 546 adolescents (11 to 18 years of age) in Montería, reported that walking was the most frequent form of travel to school (51.1%). This finding is also consistent with international studies, such as the one by Duncan *et al.*,[38] who conducted a study in 595 young people aged 5 to 16 years in New Zealand and found that 54.8%, 56.3%, and 41.4% of participants aged 1-6 years, 7-8 years, and 9-11 years, respectively, walked to school.

In the present study, several environmental characteristics were also found to be important predictors of active school transport. For example, according to the results of the multivariate analysis, the availability of sidewalks and bicycle lanes was a factor that made it easier to use active school transport (OR=0.69; 95%CI: 0.57-0.83); in other words, the unavailability of this infrastructure increased the likelihood of using motorized transport. This is in line with Hagel *et al.*,[39] who established in their study that the availability of infrastructure that facilitates active transport, such as sidewalks and bicycle lanes, is an indicator of the built environment that improves people's perception of safety during their trips. In this regard, authors such as Young *et al.*[40] state that in order to promote large increases in active transportation, it is necessary to create, enforce and fund policies across multiple sectors in a coordinated and equitable manner.

The results of the present study suggest that the perception of a boring route increases the likelihood of using passive transport (OR=1.64, 95%CI: 1.39-1.94). However, Kingsly *et al.*,[24] in a cross-sectional study involving 324 adolescents (12-17 years) from Chennai (India), did not find a relationship between the perception that routes are boring and the use of active transport (OR=1.07; 95%CI: 0.64-1.77). This difference may be explained by the fact that, as discussed by Cerin *et al.*[41] in a systematic review of 42 articles (with sample

sizes ranging from 44 to 48 879 people) on the environmental correlates of active transport in older adults, the perception of aesthetics, rather than being an essential determinant of active transport, is a facilitator when other factors, such as access to destinations and services, are fully satisfied, otherwise people give little importance to this aspect.

In the present study, dangerous crossings on the road (OR=1.29; 95%CI: 1.1-1.54), a long distance between home and school (OR=1.83; 95%CI: 1.56-2.15), and heavy traffic (OR=1.50; 95%CI: 1.24-183) were the barriers that most increased the probability of not using active transport. This coincides with what has been reported in the literature:

Veitch *et al.*,[42] in a 2010-2012 study examining 2-year changes in active transport and independent mobility in 184 children, as well as prospective associations between these behaviors and individual, social, and physical environmental predictors of interest, found that children whose mothers reported greater concerns about road safety (large barriers to walking or cycling, absence of traffic signals, crosswalks or pedestrian overpasses, need to cross multiple roads, among others) were less likely to use active transport.

Irwin *et al.*,[43] in a study in which 474 British children and adolescents were followed for 4 years to investigate changes in school travel behavior during the transition from childhood to adolescence, found that parental perceptions of road safety were associated with a variety of changes in children's behavior. Thus, greater parental perception of heavy traffic led to increased odds of using passive transport (OR=3. 40; 95%CI: 1.49-7.75), while lower parental perception of bike lane safety led to increased odds of using active transport (OR=4.46; 95%CI: 1.71-11.63).

Finally, Hino *et al.*,[44] in a cross-sectional study in which 1 545 parents of children aged 6-12 years residing in Chiba, Japan, were surveyed online on November 25-27, 2020, to examine associations between neighborhood construction, safety, and social environments with walking to and from school, found that in neighborhoods with high levels of road interconnectedness, walkers to school were less frequent (OR=1.75; 95%CI: 1.17-2.61).

One of the strengths of the present study is that the sample was relatively large for the urban and rural areas of the Colombian Caribbean region, allowing the representativeness of the population of schoolchildren in the participating educational institutions. Weaknesses include its cross-sectional design, which does not allow estimating causal relationships between the variables studied, and the fact that the data were obtained by self-reporting and the findings are the product of the subjective measurement of the participants about their immediate environment. The latter aspect may cause an overestimation or underestimation of the information collected, although these are the methods recommended for the development of studies such as the present one with large populations.

Conclusions

Active school transport is a promising alternative for incorporating PA into the daily routine of children and adolescents. Therefore, it is necessary to work in an intersectoral and interdisciplinary manner to provide the safety, infrastructure and cultural conditions that allow walking and cycling to be appealing and sustainable mobility options. In this sense, the findings of this study provide timely evidence to understand the main barriers to active transport in the Colombian Caribbean and can also contribute to public policy decisions related to the promotion of active transport modes in the region.

Conflicts of interest

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References

1. Luciani S, Agurto I, Caixeta R, Hennis A. Prioritizing noncommunicable diseases in the Americas region in the era of COVID-19. Rev Panam Salud Publica. 2022;46:e83. https://doi.org/k8xm.
2. Medina C, Jáuregui A, Campos-Nonato I, Barquera S. Prevalencia y tendencias de actividad física en niños y adolescentes: resultados de la Ensanut 2012 y Ensanut MC 2016. Salud Publica Mex. 2018;60(3):263-71. https://doi.org/j9wh.
3. Larouche R, Saunders TJ, Faulkner GE, Colley R, Tremblay M. Associations between active school transport and physical activity, body composition, and cardiovascular fitness: A systematic review of 68 studies. J Phys Act Health. 2014;11(1):206-27. https://doi.org/f5pf9d.
4. World Health Organization (WHO). WHO guidelines on physical activity and sedentary behaviour. Geneva: WHO; 2020.
5. Foster C, Moore JB, Singletary CR, Skelton JA. Physical activity and family-based obesity treatment: a review of expert recommendations on physical activity in youth. Clin Obes. 2018;8(1):68-79. https://doi.org/ghf8z5.
6. van de Kop JH, van Kernebeek WG, Otten RHJ, Toussaint HM, Verhoeff AP. School-Based Physical Activity Interventions in Prevocational Adolescents: A Systematic Review and Meta-Analyses. J Adolesc Health. 2019;65(2):185-94. https://doi.org/k8xn.
7. Garnham-Lee KP, Falconer CL, Sherar LB, Taylor IM. Evidence of moderation effects in predicting active transport to school. J Public Health (Oxf). 2017;39(1):153-62. https://doi.org/k8xp.
8. Jáuregui A, Medina C, Salvo D, Barquera S, Rivera-Dommarco JA. Active Commuting to School in Mexican Adolescents: Evidence From the Mexican National Nutrition and Health Survey. J Phys Act Health. 2015;12(8):1088-95. https://doi.org/f73786.
9. Herazo-Beltrán Y, Vidarte-Claros J, Sánchez-Guette L, Galeano-Muñoz L, Córdoba-Camacho J, Acuña-Álvarez G, *et al.* Nivel de actividad física e índice de masa corporal en escolares de la región caribe colombiana: estudio multicéntrico. Revista Latinoamericana de Hipertensión. 2019;14(4):386-92.
10. Instituto Colombiano de Bienestar Familiar (ICBF). ENSIN: Encuesta Nacional de la Situación Nutricional 2015. Bogotá D.C.: ICBF; 2015 [cited 2023 Dec 15]. Available from: https://bit.ly/48mfPaH.
11. González SA, Triana CA, Abaunza C, Aldana L, Arias-Gómez LF, Bermúdez J, *et al.* Results from Colombia's 2018 Report Card on Physical Activity for Children and Youth. J Phys Act Health. 2018;15(S2):S335-7. https://doi.org/k8xr.
12. Rahman ML, Pocock T, Moore A, Mandic S. Active Transport to School and School Neighbourhood Built Environment across Urbanisation Settings in Otago, New Zealand. Int J Environ Res Public Health. 2020;17(23):9013. https://doi.org/k8xs.
13. Hollein T, Vašíčková J, Bucksch J, Kalman M, Sigmundovà D, Van Dijik JP. School physical activity pólices and active transport to school among pipils in the Czech Republic. J Transp Health. 2017;6:306-12. https://doi.org/gcgtck.
14. Aranda-Balboa MJ, Huertas-Delgado FJ, Herrador-Colmenero M, Cardon G, Chillón P. Parental barriers to active transport to school: a systematic review. Int J Public Health. 2020;65(1):87-98. https://doi.org/gp8tnb.
15. Jones RA, Blackburn NE, Woods C, Byrne M, van Nassau F, Tully MA. Interventions promoting active transport to school in children: A systematic review and meta-analysis. Prev Med. 2019;123:232-41. https://doi.org/gqpw5r.
16. Kek CC, García-Bengoechea E, Spence JC, Mandic S. The relationship between transport-to-school habits and physical activity in a sample of New Zealand adolescents. J Sport Health Sci. 2019;8(5):463-70. https://doi.org/k87b.

17. Martínez-Martínez J, Aznar S, González-Víllora S, López-Sánchez GF. Physical activity and commuting to school in spanish nine-year-old children: Differences by gender and by geographical environment. Sustainability. 2019;11(24):7104. https://doi.org/gm8j6v.
18. Yang Y, Hong X, Gurney JG, Wang Y. Active Travel to and From School Among School-Age Children During 1997-2011 and Associated Factors in China. J Phys Act Health. 2017;14(9):684-91. https://doi.org/gbz75c.
19. Kontou E, McDonald NC, Brookshire K, Pullen-Seufert NC, LaJeunesse S. U.S. active school travel in 2017: Prevalence and correlates. Prev Med Rep. 2019;17:101024. https://doi.org/gn832t.
20. Rodríguez-Rodríguez F, Cristi-Montero C, Celis-Morales C, Escobar-Gómez D, Chillón P. Impact of Distance on Mode of Active Commuting in Chilean Children and Adolescents. Int J Environ Res Public Health. 2017;14(11):1334. https://doi.org/gcrj2w.
21. Camargo EM, Silva MPD, Mota J, Campos W. Prevalence and factors associated with active transportation to school for adolescents. Rev Saude Publica. 2020;54:78. https://doi.org/k8xq.
22. Rothman L, Macpherson AK, Ross T, Buliung RN. The decline in active school transportation (AST): A systematic review of the factors related to AST and changes in school transport over time in North America. Prev Med. 2018;111:314-22. https://doi.org/gdp3tv.
23. Sallis JF, Cervero RB, Ascher W, Henderson KA, Kraft MK, Kerr J. An ecological approach to creating active living communities. Annu Rev Public Health. 2006;27:297-322. https://doi.org/fh8cv2.
24. Kingsly A, Timperio A, Veitch J, Salmon J, Pradeepa R, Ranjani H, *et al.* Individual, social and environmental correlates of active school travel among adolescents in India. Int J Environ Res Public Health. 2020;17(20):7496. https://doi.org/k885.
25. Mandic S, Hopkins D, García Bengoechea E, Moore A, Sandretto S, Coppell K, *et al.* Built environment changes and active transport to school among adolescents: BEATS Natural Experiment Study protocol. BMJ Open. 2020;10(3):e034899. https://doi.org/gjns3w.
26. Arango CM, Parra DC, Eyler A, Sarmiento O, Mantilla SC, Gomez LF, *et al.* Walking or bicycling to school and weight status among adolescents from Montería, Colombia. J Phys Act Health. 2011;8(Suppl 2):S171-7. https://doi.org/dx9f.
27. D'Haese S, De Meester F, De Bourdeaudhuij I, Deforche B, Cardon G. Criterion distances and environmental correlates of active commuting to school in children. Int J Behav Nutr Phys Act. 2011;8:88. https://doi.org/dgv5r2.
28. Molina-García J, Queralt A, Estevan I, Álvarez O, Castillo I. Barreras percibidas en el desplazamiento activo al centro educativo: fiabilidad y validez de una escala. Gac Sanit. 2016;30(6):426-31. https://doi.org/k886.
29. World Medical Association (WMA). WMA Declaration of Helsinki – Ethical principles for medical research involving human subjects. Fortaleza: 64th WMA General Assembly; 2013.
30. Colombia. Ministerio de Salud y Protección Social. Resolución 8430 de 1993: Por la cual se establecen las normas científicas, técnicas y administrativas para la investigación en salud. Bogota D.C.; October 4 1993.
31. Qiu Y, Fernández-García B, Lehmann HI, Li G, Kroemer G, López-Otín C, *et al.* Exercise sustains the hallmarks of health. J Sport Health Sci. 2023;12(1):8-35. https://doi.org/k889.
32. Mehdizadeh M, Mamdoohi A, Nordfjaern T. Walking time to school, children's active school travel and their related factors. J Transp Health. 2017;6:313-26. https://doi.org/gcgtd3.
33. Jurak G, Soric M, Sember V, Djuric S, Starc G, Kovac M, *et al.* Associations of mode and distance of commuting to school with cardiorespiratory fitness in Slovenian schoolchildren: a nationwide cross-sectional study. BMC Public Health. 2021;21(1):291. https://doi.org/g3wg.
34. Larouche R. Last Child Walking? - Prevalence and Trends in Active Transportation. In: Larouche, editor. Children's Active Transportation. Cambridge: Elsevier Inc; 2018. p. 53-75. https://doi.org/k887.
35. Ruiz-Ariza A, de la Torre-Cruz M, Redecillas-Peicó M, Martínez-López E. Influencia del desplazamiento activo sobre la felicidad, el bienestar, la angustia psicológica y la imagen corporal en adolescentes. Gac Sanit. 2015;29(6):454-7. https://doi.org/f3g84g.
36. Chillón P, Martínez-Gómez D, Ortega FB, Pérez-López IJ, Díaz LE, Veses AM, *et al.* Six-year trend in active commuting to school in Spanish adolescents. The AVENA and AFINOS Studies. Int J Behav Med. 2013;20(4):529-37. https://doi.org/f25g8t.
37. González SA, Sarmiento OL, Lemoine PD, Larouche R, Meisel JD, Tremblay MS, *et al.* Active school transport among children from Canada, Colombia, Finland, South Africa, and the United States: A tale of two journeys. Int J Environ Res Public Health. 2020;17(11):3847. https://doi.org/gkb5qz.
38. Duncan S, White K, Mavoa S, Stewart T, Hinckson E, Schofield G. Active transport, physical activity, and distance between home and school in children and adolescents. J Phys Act Health. 2016;13(4):447-53. https://doi.org/f8mt69.
39. Hagel BE, Macpherson A, Howard A, Fuselli P, Cloutier MS, Winters M, *et al.* The built environment and active transportation safety in children and youth: a study protocol. BMC Public Health. 2019;19(1):728. https://doi.org/gf8p6r.
40. Young DR, Cradock AL, Eyler AA, Fenton M, Pedroso M, Sallis JF, *et al.* Creating Built Environments That Expand Active Transportation and Active Living Across the United States: A Policy Statement From the American Heart Association. Circulation. 2020;142(11):e167-83. https://doi.org/ghqxm6.

41. Cerin E, Nathan A, van Cauwenberg J, Barnett DW, Barnett A. The neighbourhood physical environment and active travel in older adults: a systematic review and meta-analysis. Int J Behav Nutr Phys Act. 2017;14(1):15. https://doi.org/ggn37x.
42. Veitch J, Carver A, Salmon J, Abbott G, Ball K, Crawford D, *et al.* What predicts children's active transport and independent mobility in disadvantaged neighborhoods? Health Place. 2017;44:103-9. https://doi.org/ggkntz
43. Irwin J, van Sluijs EMF, Panter J, Jones A. The socio-ecological determinants of change in school travel mode over the transition from childhood to adolescence and the association with physical activity intensity. Health Place. 2021;72:102667. https://doi.org/gqzff2.
44. Hino K, Ikeda E, Sadahiro S, Inoue S. Associations of neighborhood built, safety, and social environment with walking to and from school among elementary school-aged children in Chiba, Japan. Int J Behav Nutr Phys Act. 2021;18(1):152. https://doi.org/k9cf.